

05

CPSC-I-05-0003

**INTERAGENCY AGREEMENT**

**BETWEEN THE**

**U.S. CONSUMER PRODUCT SAFETY**  
**COMMISSION**

**AND**

**NAVAL RESEARCH LABORTORY**

Revised 06/28/2005

## A. DESCRIPTION OF SERVICES

The Naval Research Laboratory (NRL) shall investigate the feasibility of incorporating off-the-shelf wireless fire/smoke/flame/heat detector technology and concepts into home appliances and other equipment to improve the detection of fire in a residential home.

## B. CONTRACT TYPE

This is a firm-fixed price agreement.

## C. BACKGROUND

1. According to estimates by the National Fire Protection Association and the U. S. Fire Administration, U.S. home usage of smoke alarms rose from less than 10% in 1975 to at least 95% in 2000, while the number of home fire deaths was cut nearly in half. The home smoke alarm has been credited as one of the greatest success stories in fire safety in the last part of the 20<sup>th</sup> century. A key component that helped launch the use of smoke alarms in homes was the independent set of tests (a.k.a. Dunes Tests) conducted in 1975-76 by the National Bureau of Standards (now the National Institute of Standards and Technology, NIST). These tests demonstrated the potential for smoke alarms to save lives.
2. In 2000, the U.S. Consumer Product Safety Commission (CPSC) staff coordinated the evaluation of current and emerging smoke alarm technology responses to common residential fire scenarios and nuisance alarm sources. CPSC staff worked with interested organizations such as the U.S. Fire Administration (USFA), the National Institute for Standards and Technology (NIST), the Centers for Disease Control and Prevention (CDC), the U.S. Department of Housing and Urban Development (HUD), the National Fire Protection Association (NFPA), and Underwriters Laboratories, Inc. (UL) in developing and funding a two-year project for evaluating smoke alarms in full-scale fire tests.
3. The project was initiated in October 2000 and completed in December 2002 by NIST under the direction of a steering committee of the sponsoring organizations along with NFPA, the University of Maryland, and the National Research Council of Canada. At the completion of the project, NIST released a technical report, *Performance of Home Smoke Alarms, Analysis of the Response of Several Available Technologies in Residential Fire Settings (NIST Technical Note 1455) December 2003*.
4. Tests were conducted in actual homes of representative sizes and floor plans, utilized actual furnishings and household items for fire sources, and tested actual smoke alarms currently sold in retail stores. Smoke alarm performance was quantified in terms of the escape time provided by groups of alarms installed in accordance with typical code provisions.

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5. The NIST testing showed that using alarms in the bedrooms, in addition to placement of alarms on every level, reduced the time to alarm for every fire scenario tested with most alarm technologies. Adding an alarm in the bedroom provided an additional 3 to 923 seconds (15 minutes, 23 seconds) of available egress time, depending on the fire scenario. As expected, alarm times for the bedroom fire scenarios were most affected by the additional alarms, since alarms were now included in the room of fire origin.
6. Adding interconnected smoke alarms in bedrooms increased the escape time provided, especially for smoldering fires. Smoke alarms in the bedrooms increased the escape time as much as 900 seconds (15 minutes). The report states that the test data provides a basis for evaluating whether smoke alarms should be required in bedrooms of homes built prior to 1993.
7. Interconnected smoke alarms allow all of the smoke alarms in a home to sound if any individual smoke alarm detects smoke. This can result in an increase in the amount of time available for an occupant to egress the home, if the initiating smoke alarm sounds in the farthest part of the home. Many homes do not have the added protection provided by interconnected smoke alarms. Most homes in the U.S. were constructed before hardwired and interconnected smoke alarms were required by the National Fire Alarm Code (NFPA 72).
8. Before NFPA 72 required interconnected smoke alarms on every level of the home and outside the sleeping area, battery-only-powered smoke alarms were typically installed in homes. Depending on the size and layout of the home, if a fire occurred in a remote section of the home – away from the bedrooms – the closest smoke alarm to the fire would sound. However, such a remote alarm may not be sufficiently audible to be heard by some occupants or to awaken sleeping occupants. As the fire progresses and smoke travels to a smoke alarm that is closer the occupants this may result in a sound level sufficient to awaken or be heard by the occupants. The delay before a closer smoke alarm notifies the occupants may dramatically reduce the amount of escape time, perhaps leaving the occupants with only seconds to exit the home.
9. Beginning in 1989, NFPA 74 (later renamed to NFPA 72) required interconnected smoke alarms on every level of the home and outside the sleeping area for new construction. This was typically referred to as “hardwired” smoke alarms. NFPA 74 did not require smoke alarms in the bedrooms nor did it require hardwired smoke alarms to have battery back-up. The Code also did not require existing homes to be retrofitted with interconnected smoke alarms, largely because of the financial burden this would place on homeowners.
10. NFPA 72 was later changed in 1993 to require installation of hardwired smoke alarms in the bedrooms or sleeping area. This change to require smoke alarms in the bedrooms was to address the concern associated with the loss in sound level when occupants sleep with the bedroom doors closed. The interconnected smoke alarm in the bedroom provided increased assurance that the alarm sound level would be sufficient to wake sleeping occupants, and it also provided additional protection if the bedroom was the room of fire origin.

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11. Today's technology may allow a battery powered smoke alarm to communicate with other smoke alarms in the home without significantly increasing the manufacturing cost or depleting the life of a standard 9-volt alkaline battery within a year.
12. In 2003, CPSC contracted with the Naval Research Laboratory (NRL) to determine the feasibility of incorporating wireless technology in battery-powered smoke alarms, which allows them to communicate with each other. Wireless technology in a smoke alarm could also be used to trigger remote-dependent devices that output sound at a frequency lower than a piezoelectric horn. The remote-dependent devices could be powered by 120 VAC and could plug into a household receptacle.
13. The work by the Naval Research Laboratory demonstrated that it is feasible to incorporate wireless technology into battery-powered smoke alarms. NRL built prototype smoke alarms using a transmitter and receiver circuit in each of the prototype alarms. If any smoke alarm detected smoke, it transmitted a signal to the other smoke alarms. Each receiving smoke alarm also acted like a repeater; thus, a smoke alarm that may have been too far away to be activated by the initiating smoke alarm could be activated by a closer smoke alarm that was transmitting an alarm signal. The transmitting range and the rate at which the receiver checked for an alarm signal were factors in determining the power requirements. To be an effective system, all the smoke alarms in the home would need to include RF transmitter/receiver circuitry. This method would improve audibility by sounding all smoke alarms when any one smoke alarm detected smoke.
14. The recent NIST testing concluded that smoke alarms of either the ionization type or the photoelectric type consistently provided some amount of escape time. However, the escape times measured in this study were systematically shorter than those found in the "Dunes Tests" study conducted in the 1970s. This is attributed to a combination of factors: faster fire development times for today's products that provide the main fuel sources for fires, different criteria for time to untenable conditions, and improved understanding of the speed and range of threats to tenability. In many cases, available escape times would be sufficient only if the occupants followed the advice of fire safety educators, including sleeping with doors closed while using interconnected smoke alarms to provide an audible alarm in each bedroom, and pre-planning and practicing escape so as to minimize pre-movement and movement times during egress.

#### D. OBJECTIVE

1. The objective of this project is to determine if wireless fire/smoke alarm technology can be used in household appliances to further reduce the threat of loss of life in residential fires by allowing increased egress time in a fire scenario.

**E. STATEMENT OF WORK**

1. The NRL shall furnish all necessary personnel, materials, equipment, services, and facilities necessary to complete the tasks set forth herein.
2. NRL will investigate the feasibility of incorporating off-the shelf technology and concepts to improve the detection of fire in residential homes. NRL will evaluate using wireless technology to improve the detection of fire in a residential home. Concepts of using a remote detector that transmits a signal to base smoke alarms will be evaluated. The concept of incorporating fire breaching detection sensors in appliances or other home equipment that will transmit a wireless signal to a base smoke alarm will be evaluated. The following tasks provide further explanation.

**a. TASKS**

1. NRL & CPSC shall, at a minimum, discuss progress and other issues every 90 days starting from award of contract. First meeting to take place within thirty (30) days after award.
2. NRL shall investigate various suitable detection technology and methods to allow earlier detection of flaming fires in a small appliance, such as a toaster oven. The detection technology NRL proposes for use will be discussed with CPSC staff prior to implementation. The small appliance to be used to incorporate the detection technology shall be reviewed and approved by CPSC staff prior to implementation.
3. NRL shall investigate and determine whether wireless technology previously developed NRL or similar technology used to signal smoke alarms for earlier fire detection of appliance based fires, can be used to decrease the detection time of a fire.
4. NRL shall determine the method of incorporating wireless smoke/fire alarm technology into a home appliance. Discuss and report power requirements, and evaluate possible advantages and disadvantages for consumers and manufacturers. Discuss and report the use of the NRL developed wireless smoke detectors to form a fire detection system to demonstrate decreased alarm time when used to alarm to appliance fires.
5. NRL shall configure and construct a prototype fire alarm system using the previously developed NRL wireless smoke/fire alarm technology and methods and off-the-shelf fire/smoke/flame/heat sensors to equip a small appliance, such as a microwave oven, to demonstrate detection times when appliance fires are detected and alarms are wirelessly transmitted to wireless smoke alarms.
6. NRL shall test the prototype smoke/fire alarm system.

7. NRL shall prepare and deliver a report of findings describing the tasks performed, and findings for the entire project. The report shall include schematics, parts list, photographs of the prototypes, and description of how the prototype was constructed and tested.

## F. DELIVERY AND PAYMENT SCHEDULE

	<i>ITEM</i>	<i>Quantity</i>	<i>Delivery or Performance</i>	<i>Payment</i>
1.	Meet with CPSC to discuss detection technology proposed for use. (Task #1)	One (1)	Within 30 days after award	\$0.00
2.	Submit selected Detection Technology and proposed small appliance to be used to CPSC for approval. (Task #1)	One (1)	Within 30 days after award	\$10,000
3.	Discuss power requirements, and possible advantages and disadvantages with the CPSC. (Task #2)	One (1)	Within 6 months after award	\$0.00
4.	Discuss the fire detection system. (Task#2)	One (1)	Within 6 months after award	\$10,000
5.	Configure a prototype fire alarm system. (Task#4)	One (1)	Within 10 months after award	\$40,000
6.	Construct a prototype smoke alarm or fire alarm system. (Task#5)	One (1)	Within 10 months after award	\$10,000
7.	Test the prototype smoke alarms or fire alarm system (Task#6)	One (1)	Within 10 months after award	\$10,000
8.	Progress reports (Task#1)	Three (3)	Every 90 days after award	\$0.00
9.	Delivery of Final report, prototypes and test data. (Task #7)	One (1)	Not later than 12 months after contract award	\$10,000

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## **G. MODIFICATION AND CANCELLATION**

This agreement may be modified by mutual consent of both parties or canceled upon 30 days advance written notice by either party.

## **H. PAYMENT**

1. Payment will be made in advance by means of the Intra Government Payment and Collection (IPAC) System.
2. NRL will return any unexpended funds in excess of performance. NRL will only be paid for services actually rendered.
3. Total payment to NRL shall not exceed \$90,000.00 for services completed. Funds will be transferred electronically through the use of the IPAC system (see section R).

## **I. DISCLOSURE OF INFORMATION:**

1. NRL shall not disclose any information concerning any work performed under this agreement without the express written permission of the Commission. The NRL shall submit to the Commission any report, manuscript or other document containing the results of work performed under this Agreement, before such document is published or otherwise disclosed to the public, to assure that there is no pending investigation associated with the sample tested and to assure compliance with Section 6(b) of the Consumer Product Safety Act (15 U.S.C. Section 2055(b)), Commission regulations (16 C.F.R. Part 1101), and a Commission directive (Order 1450.2). These provisions restrict disclosure by the Commission or its agents of information that (1) permits the public to identify particular consumer products or (2) reflects on the safety of a class of consumer products. Prior submission allows the Commission staff to review the information and comply with the applicable restrictions. CPSC should be advised of the NRL's desire to submit or publish an abstract or a report as soon as practical.
2. Any publications of or publicity pertaining to, the work performed under this Agreement shall include the following:

"This project includes or is based on data that was acquired with funds from the Consumer Product Safety Commission. The content of this publication does not necessarily reflect the views of the Commission, nor does mention of trade names, commercial products, or organizations imply endorsement by the Commission.

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**L. CPSC AGENCY PAYMENT OFFICER:**

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**M. CPSC CONTRACT SPECIALIST**

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**N. NRL PROJECT MANAGER:**

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Navy Technology Center for Safety and Survivability  
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4555 Overlook Ave., NW



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Washington, DC 20375

Project Manager: Thomas T. Street  
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Facsimile: (202) 767-1716

**O. PERIOD OF AGREEMENT:**

From date of fully executed agreement through 12 months.

**P. DISAGREEMENTS**

In the event that CPSC and NRL have a disagreement arising under this interagency agreement, the parties shall cooperatively seek to resolve the disagreement by themselves. If the disagreement cannot be resolved between them, the parties agree to seek the assistance of a third party in resolving the disagreement.

**Q. BILLING:**

NRL shall bill CPSC quarterly for the cost of tasks to be performed in the following quarter. NRL shall provide an accounting for its expenditure of each quarterly payment on a deliverable by deliverable basis.

**R. FUNDING AND ACCOUNTING DATA:**

The transfer of funds should be through the Intra-Government Payment and Collection (IPAC) system.

**TRANSFER FROM:**

CPSC Accounting and Appropriation Data: \$90,000.00

05 PS EXOB 4400 21557 253a

**TRANSFER TO:**

NRL Accounting and Appropriation Data:

Appropriation:

CAN:

PMS:

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Object Class:  
Agency Location number: 00008522

**S. AUTHORITY:**

1. General Authority: Economy Act of 1932, as amended 31 USC 1535; (1996)
2. CPSC Authority: Section 27(g) of the Consumer Product Safety Act, 15 USC 2076(g);

**T. FASA COMPLIANCE:**

As the servicing agency, NRL agrees to act in full compliance with Section 1074 of the Federal Acquisition Streamlining Act (FASA) of 1994 entitled ECONOMY ACT PURCHASES.

APPROVED AND ACCEPTED FOR THE  
UNITED STATES CONSUMER PRODUCT  
COMMISSION

APPROVED AND ACCEPTED FOR  
THE NAVAL RESEARCH LABORATORY

BY: Donna Hurton

BY: Frederick Williams

SIGNATURE: 

SIGNATURE: 

TITLE: Contracting Officer

TITLE: Supvry Research Chemist

DATE: 6/29/05

DATE: 7/27/05